3D Modeling of Retina using Polymer Scaffolds for Understanding Disease Pathogenesis

Grant Award Details

3D Modeling of Retina using Polymer Scaffolds for Understanding Disease Pathogenesis

Grant Type: Basic Biology IV

Grant Number: RB4-05785

Project Objective: The PI is using a novel 3D micropatterned biomaterial to culture and grow hESCs and iPSC-derived retinal cells including photoreceptors. Once optimized, the constructs will be validated with Retinitis Pigmentosa patient-derived iPSCs. The PI will then use this system to understand the basic biology of the disease and to assess the mechanism of the tissue repair in vitro following gene replacement.

Investigator:

Name:	Deepak Lamba
Institution:	Buck Institute for Age Research
Type:	PI

Disease Focus: Vision Loss

Human Stem Cell Use: Embryonic Stem Cell, iPS Cell

Cell Line Generation: iPS Cell

Award Value: $1,212,553

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Reporting Period: Year 3/NCE

View Report

Grant Application Details

Application Title: 3D Modeling of Retina using Polymer Scaffolds for Understanding Disease Pathogenesis

Public Abstract: Inherited retinal degenerations result in visual loss in patients as early as in their adolescence. Retinitis Pigmentosa includes a group of such degenerations which run in families and can result in legal blindness by 40 years of age. Even though we know by now a number of gene mutations which can cause these disorders, we do not understand how these mutations ultimately lead to loss of the cells. Recent advances in stem cell technologies now have provided us with the opportunity to gain a better understanding of the disorders.
In this proposal, we plan to study the degenerative process by creating an eye-like structure in a dish using a combination of stem cell and bioengineering approaches. We plan to use 3D scaffolds to grow eye cells generated from pluripotent stem cells. We will directly compare normal retinal cells with cells derived from patients with Retinitis Pigmentosa. This approach will allow us to identify the processes that ultimately lead to the death of the photoreceptor cells int he eye and blindness. In the future, we could then extend this work to identify new drugs which will help halt or at least slow down the degeneration in these patients.

Statement of Benefit to California: Photoreceptor degenerations, including Retinitis Pigmentosa (RP), cause visual impairment for millions of patients in the United States and a number of patients in the state of California being one of the most populous states in the US. RP encompasses a group of retinal degeneration with a prevalence of 1 in 4000 and runs in families. Typical symptoms include night blindness followed by decreasing vision, and eventually legal blindness or, in many cases, complete blindness. RP is usually diagnosed in adolescents and young adults. Most people with RP are legally blind by age 40. There are no effective forms of treatment for a majority of these patients. Thus results in a tremendous stress on the state of CA's resources. In addition, there is both monetary and psychological stress on the families esp. in cases of Retinitis Pigmentosa as multiple family members are affected.

The only way to potentially help these patients will be to either replace the dead cells with new photoreceptors or find ways to better understand the degenerative process in order to identify novel drugs to delay the progression of degeneration. The proposed research in this application is to generate eye tissue in a dish from patients with severe forms of Retinitis Pigmentosa in order to gain a better understanding of the disease. This will in turn help us in the future to identify new drugs to delay or stop the visual loss and this will attract new biotechnology partners in the state of CA.